Sampling Strategy, Production Strategy, and Configuration Code Implementation

at the

Langley TRMM and Terra Information System (LATIS)

by

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Introduction

The Clouds and the Earth's Radiant Energy System (CERES) is a key component of the Earth Observing System (EOS) program. The CERES instrument provides radiometric measurements of the Earth's atmosphere from three broadband channels: a shortwave channel (0.3 - 5 mm), a total channel (0.3 - 200 mm), and an infrared window channel (8 - 12 mm). The CERES instruments are improved models of the Earth Radiation Budget Experiment (ERBE) scanner instruments, which operated from 1984 through 1990 on the National Aeronautics and Space Administration's (NASA) Earth Radiation Budget Satellite (ERBS) and on the National Oceanic and Atmospheric Administration's (NOAA) operational weather satellites NOAA-9 and NOAA-10. The strategy of flying instruments on Sun-synchronous, polar orbiting satellites, such as NOAA-9 and NOAA-10, simultaneously with instruments on satellites that have precessing orbits in lower inclinations, such as ERBS, was successfully developed in ERBE to reduce time sampling errors. CERES continues that strategy by flying instruments on the polar orbiting EOS platforms simultaneously with an instrument on the Tropical Rainfall Measuring Mission (TRMM) spacecraft, which has an orbital inclination of 35 degrees. In addition, to reduce the uncertainty in data interpretation and to improve the consistency between the cloud parameters and the radiation fields, CERES includes cloud imager data and other atmospheric parameters. The TRMM satellite carries one CERES instrument while the EOS satellites carry two CERES instruments, one operating in a fixed azimuth plane scanning mode (FAPS) for continuous Earth sampling and the other operating in a rotating azimuth plane scan mode (RAPS) for improved angular sampling.

1.0 Purpose

The purpose of this document is to outline the responsibilities of the CERES Data Management Team (DMT), the CERES Software Development Teams and the Langley TRMM and Terra Information System (LATIS) personnel for a semi-automated implementation of the ConfigurationCode in the Production Processing of the CERES data at the Langley Distributed Active Archive Center (DAAC). This document will also describe the implementation of the SamplingStrategy identifiers, the multi-ProductionStrategy identifiers, and the Software and Constant Ancillary Data identifiers.

The treatment and methodology of the ConfigurationCode and other parameters contained in this document is to be used as an interim process until the LATIS processing system is fully automated. The definition of the fully automated processing system can be found in the 'CERES TRMM Processing Requirements at the LaTIS', m.v.mitchum, a CERES internal document.

This document is organized as follows:

2.0 Background Information

2.1 CERES Data Management System

The CERES Data Management System supports the data processing needs of the CERES Science Team research to increase the understanding of the Earth's climate and radiant environment. The CERES Data Management Team works with the CERES Science Team to develop the software necessary to support the science algorithms. This software, being developed to process at the Langley DAAC, produces an extensive set of science data products.

The Data Management System consists of 12 major Subsystems. The 12 Subsystems have been separated into 14 Data Processing Subsystems where each subsystem represents one or more stand-alone Product Generation Executive (PGE), or executable programs. Each Subsystem executes when all of its required input data sets are available and produces one or more science product. Reference Appendix A for an overview Subsystem Dependency Diagram.

An Operator's Manual is written for the data processing operations staff at the Langley DAAC by the Software Development Team responsible for each Subsystem. Each volume describes all PGEs for a particular Subsystem and contains the Environment Parameters, Run-time Parameters, Production Request Parameters, the required inputs, the steps used to execute, and the expected outputs for each executable included within the Subsystem.

In the following discussion a Processing Control File (PCF) will be referenced. The PCF is a file which is built at process instantiation and contains all of the necessary knowledge of the required inputs, run-time parameters, and expected outputs of a PGE.

Since this is an on-going development project, the charts and tables contained in this document will be valid as of the date of this printing. **All detail information required for a PGE must be sourced from the respective Subsystem' Operator's Manual, a deliverable to the LATIS system.**

2.2 CERES Output Filenaming Convention

The SamplingStrategy (SS), ProductionStrategy (PS), and the ConfigurationCode (CCode) are an integral part of the CERES Output Filenaming Convention, as defined by the CERES Instrument Team (IT) lead, Dr. Bruce Barkstrom. A typical output file name is shown as:

	[CER]_[Product-ID]_[SS]_[PS]_[CCode].[Instance]					
Source:	fixed	fixed	RP	RP	DB	RP

Note: Field separators will be the underscore (_) except for the last field, where a period (.) is required before the Instance

Product-ID: predefined name for each output product
Instance: Year/Month/Day/Hour as applicable to the product.

Source: fixed - predefined name
RP - Run-time Parameter, defined at Production Request Time, see Section 3.
DB - Retrieved from DAAC Configuration Management Database, see Section 5.

Example Filename: **CER_SSF_TRMM-PFM-VIRS_ValidationR1_014011.1998020512**

3.0 CERES DMT to DAAC Processing Request Form

A form has been established by the CERES Data Management Team to formally submit Production Requests at the DAAC. The name of the form is 'CERES DMT to DAAC Processing Request' and can be found at: http://asd-www.larc.nasa.gov/ceres/dmt2daac/

When the 'CERES DMT to DAAC Processing Request' is submitted to the DAAC, the SamplingStrategy, ProductionStrategy and Processing Instance will be defined for each Processing Request.

4.0 CERES Data Processing Procedure Policy

In order for the required processing elements to be predictable, such as ConfigurationCode numbers, the following restriction has been placed on the CERES Data Processing Procedures:

All monthly processing for a DataDateYear, DataDateMonth and ProductionStrategy (for each SamplingStrategy) must be processed with the same software and constant ancillary data and remain constant for the DataDateMonth.

If a new version of a subsystem is delivered while that subsystem is processing a DataDateMonth,

either the monthly processing is finished with the earlier version of the subsystem, or a special request has to be submitted, by the Data Management Team, for reprocessing the DataDateMonth with the new version of the Subsystem.

5.0 CERES SamplingStrategy

The CERES Data Management System supports three Satellites carrying five Instruments. The CERES Satellite-Instrument combinations are: {TRMM-PFM, Terra-FM1, Terra-FM2, Aqua-FM3, and Aqua-FM4}. The Imagers on the 3 Satellites are: {VIRS, MODIS, MODIS}.

Definition: SamplingStrategy (SS#) is a term that is used to describe the '**source**' of the data used in a production process. For CERES' Instrument-dependent processors, SS# is defined as a combination of the {Satellite-Instrument-Imager} identifier. Each CERES PGE will use a specified notation for the SamplingStrategy identifier (SS#). Not all PGEs have unique SS# notations; meaning that some Subsystems may have one SS# to be used by several PGEs. The SamplingStrategy notation is 'SS' followed by a number that describes the Subsystem and associated PGE.

For example: Subsystem 2, PGE: CER2.1P1, uses: SS2_1 and
Subsystem 2, PGE: CER2.2P1, uses: SS2

In this example, SS2_1 and SS2 are unique identifiers which contain different values. PGE: CER2.1P1 is a CERES Instrument-independent processor and PGE: CER2.2P1 is a CERES Instrument-dependent processor. The SamplingStrategies have been pre-determined by the CERES IT and the CERES Data Management Team (DMT) and are supplied to the DAAC at Processing Request Time, see Section 3.

Note: The PGEs that are CERES Instrument-independent, will contain the generic value 'CERES' as the SamplingStrategy identifier.

Table 1 lists some example SamplingStrategy identifiers for single instrument processors, per Subsystem, generic names where: SAT = Satellite, INST = Instrument and IMAG = Imager, and the values that have been defined for the TRMM mission.

Table 1: Example SamplingStrategy Identifiers for Single Instrument Processing

Subsystem#	SubsystemName/ Processor	SamplingStrategy Identifiers	Generic SS	TRMM SS Values
1	Instrument	SS1	SAT-INST	TRMM-PFM
2*	ERBElike (Snow)	SS2_1	fixed: CERES	CERES
2	ERBElike (Daily)	SS2	SAT-INST	TRMM-PFM
3	ERBElike (Monthly)	SS3	SAT-INST	TRMM-PFM
4.1-4.4*	Clouds(Snow)	SS4_0	fixed: CERES	CERES
4.1-4.4	Clouds(Cloudproperties)	SS4_1	SAT-IMAG	TRMM-VIRS

Table 1: Example SamplingStrategy Identifiers for Single Instrument Processing

Subsystem#	SubsystemName/ Processor	SamplingStrategy Identifiers	Generic SS	TRMM SS Values
4.1-4.4	Clouds(Cookiecutter)	SS4_4	SAT-INST-IMAG	TRMM-PFM-VIRS
4.5-4.6	Inversion	SS4_5	SAT-INST-IMAG	TRMM-PFM-VIRS
5	InstantaneousSarb	SS5	SAT-INST-IMAG	TRMM-PFM-VIRS
6	TisaGrid(6)	SS6	SAT-INST-IMAG	TRMM-PFM-VIRS
7.1	TisaAveraging(7.1)	SS7_1	SAT-INST-IMAG	TRMM-PFM-VIRS
7.2	SynopticSarb	SS7_2	SAT-INST-IMAG	TRMM-PFM-VIRS
8	TisaAveraging(8)	SS8	SAT-INST-IMAG	TRMM-PFM-VIRS
9*	TisaGrid(9.1-Pmoa)	SS12	fixed: CERES	CERES
9	TisaGrid(9)	SS9	SAT-INST-IMAG	TRMM-PFM-VIRS
10	TisaAveraging(10)	SS10	SAT-INST-IMAG	TRMM-PFM-VIRS
11*	GGeo(Main)(i,i=1,4)	SS11_1, SS11_2, SS11_3, SS11_4	TBD, at Production time	TBD, Geostationary Sats
11*****	GGeo(Post)	SS11	fixed: CERES	CERES
12*****	RegridMOA	SS12	fixed: CERES	CERES

***** Note: These Subsystem Processors are CERES Instrument-independent.

Each PGE must design their scripts to use an environment variable for **each** SamplingStrategy (input/output SS) required in setting up their respective Process Control Files (PCF). There must be a unique SS# for **each** unique set of PGE-dependent input files and **one** unique SS# for all output files. For example: Subsystem 4.5-4.6, Inversion, PGE: CER4.5-6.1P1, requires 2 input SS#s {inSS4_4 = SS4_4, and inSS12 = SS12} and the output SS# {outSS4_5 = SS4_5} in order to identify the input and output filenames in the PCF.

Multi-Instrument SamplingStrategy will be the following:

> **The Instrument names will be strung with a plus (+) symbol between the names. The names of the Satellite and/or Imager will be dropped from the SamplingStrategy name.**

The PGE's that are effected initially by combining Instrument data are: CER3.2P1, CER6.2P1, and CER9.3P1. For example: CER9.3P1 will be supplied the following SamplingStrategy:

SS9 = PFM+FM1+FM2

6.0 CERES ProductionStrategy

The ProductionStrategy (PS) is a variable length, maximum 20 characters, description of the file version (sometimes identified as Version). Examples of PS are: 'AtLaunch', 'ValidationR1',

'ValidationR2',..., 'Edition1'. The ProductionStrategy for each PGE will be determined by the CERES IT and the CERES Data Management Team (DMT) and supplied to the DAAC at Production Request Time, see Section 3. Each CERES PGE will use a specified notation for the ProductionStrategy identifier (PS#). Not all PGEs have unique PS# notations; meaning that some Subsystems may have one PS# to be used by several PGEs. The ProductionStrategy notation is 'PS' followed by a number that describes the Subsystem and associated PGE.

For example: Subsystem 2, PGE: CER2.1P1, uses: PS2_1 and
Subsystem 2, PGE: CER2.2P1, uses: PS2

It is important to note here that a ProductionStrategy will exist, and will be unique, for **each** CERES Instrument for **each** CERES PGE.

Each PGE must design their scripts to use an environment variable for **each** ProductionStrategy (input/output PS) required in setting up their respective Process Control Files (PCF). There must be a unique PS# for **each** unique set of PGE-dependent input files and **one** unique PS# for all output files. For example: Subsystem 4.5-4.6, Inversion, PGE: CER4.5-6.1P1, requires 2 input PS#'s {inPS4_1 = PS4_1, and inPS12 = PS12} and the output PS# {outPS4_5 = PS4_5} in order to identify the input and output filenames in the PCF.

7.0 ConfigurationCode Definition

The term ConfigurationCode was created to document, identify, and track the version of Software and Ancillary Data that has produced a CERES Product. As shown above in Section 2.2, this number is written on all output filenames created by a PGE during execution. Further this number is used on all processing and log filenames.

Dilemma: When the CERES project began, the project was faced with a unique dilemma. The question was: 'How do we link two Configuration Managements Systems, one from the SW developer and one from the LATIS System, into our code?' The following is a sequence of events from developer to the processing system and a description of the methodology used to resolve this problem.

- All CERES Software and/or Constant Ancillary Data files are sent to the CERES Configuration Management (CM) System prior to DAAC Delivery. The CERES CM manager approves the package and forwards the delivery to the DAAC. (Note: Most delivery packages are ordered by Subsystem.)
- Each CERES delivery to the DAAC is accompanied by a CERES-internal System Configuration Change Request (SCCR) number, issued by the CERES CM system, and is documented in the Delivery Memo from the SW Team to the DAAC.

After the DAAC Science Software Integration and Test (SSI&T) team has completed testing the software delivery:

- the Subsystem Software (SW) and/or Constant Ancillary Data is ready to be promoted to production.
- The DAAC sends the SW and/or data files to the DAAC Configuration Management (CM)

system where the information is cataloged.

- The DAAC CM system has set up a Database table which tracks each CERES Subsystem SW and/or data deliveries, recorded by Subsystem number and PGE number. A number (cc_internal) is assigned to each Subsystem and PGE, respectively, by the DAAC CM manager.
- The Subsystem SW (sw_sccr) and /or Data (data_sccr) System Configuration Change Request (SCCR) number, established by the CERES CM system, is also recorded in the table as documented in the Delivery Memo.

Table 2 illustrates a sample of several Subsystem 1 and 2 deliveries as cataloged into the LATIS CM system.

Table 2: LATIS Configuration Management (Sample)

PGEName	SubS#	sw_date	sw_sccr	data_date	data_ sccr	cc_ internal	cc_ external	cc_date
CER1.1P1	1.0	06/25/1997	9	06/25/1997	9	1	1	
CER1.2P1	1.0	06/25/1997	9	06/25/1997	9	1	1	
CER1.1P2	1.0	08/27/1997	17	08/27/1997	17	2	1	
CER1.2P1	1.0	10/24/1997	26	10/24/1997	26	3	2	11/26/1997
CER1.2P1	1.0	1/20/1998	50	1/20/1998	50	4	2	2/1/1998
CER2.1P1	2.0	06/13/1997	5	06/13/1997	5	1	1	
CER2.1P1	2.0	12/12/1997	34	12/12/1997	34	2	2	12/29/1997

Definition: ConfigurationCode (CC# or CCode) number is a 6-digit number which is the concatenation of two 3-digit numbers. The first three digits are derived from the table above '**cc_internal**' which tracks the **internal** changes within a PGE. The last three digits **'cc_external'** tracks the **external** changes affecting a PGE as defined by the DAAC. Examples of external changes are: CERESlib updates, Operating System changes, new Toolkit, and others.

An example ConfigurationCode number will look like: **016014**, where 016 denotes the 16th delivery of the PGE to the DAAC CM and 014 denotes the 14th external change effecting the PGE.

Dilemma Solution: Prior to a PGE production process instantiation, for any DataMonth, the cc_internal, cc_external, the sw_sccr and the data_sccr are accessed from the DAAC CM Database. The ConfigurationCode number is constructed and all are provided as input environment parameters to each PGE. Thus the associated identifiers for the two CM systems are provided and used in the production process. These two sets of identifiers can be found in all metadata files created for all CERES output products as well as part of the CERES Filenaming Convention.

For a current listing of the CERES PGEs that have been logged into the LATIS CM system refer-

ence: http://latis.larc.nasa.gov:44712/config_mgmt/. Click on 'CERES CM Information'.

7.1 Subsystem ConfigurationCode Notation and Dependencies

A ConfigurationCode (CC#) number is associated with each Subsystem-PGE. The CERES Data Management Team Software Systems Engineer assigns the appropriate notation for each ConfigurationCode to be introduced into the CERES processing environment. Not all PGEs have unique CC# notations; meaning that some Subsystems may have one CC# to be used by several PGEs. The naming convention for the ConfigurationCode is 'CC' followed by a number that describes the Subsystem and associated PGE.

For example: Subsystem 2, PGE: CER2.1P1, uses: CC2_1.

Each subsystem must design their scripts to use an environment variable for **each** 6-digit ConfigurationCode (CC#) required in setting up their respective Process Control Files (PCF). There must be a unique CC# for **each** unique set of PGE-dependent input files and **one** unique CC# for the PGE output files. For example: Subsystem 5, SARB, requires the input CC#s {CC4_5, and CC12} and output CC# {CC5} in order to identify the input and output filenames in the PCF.

7.2 SSI&T ConfigurationCodes

For SSI&T, use all zeros, 000000, for input and output ConfigurationCode numbers using the implementation method as described below in Section 9.

7.3 'External' ConfigurationCode Element

The external ConfigurationCode element (the last 3 digits) of the identifier, at the time of this writing, is done by manual logs. Appendix A contains a proposed set of CM Tables designed to track and document the external changes that effect each CERES PGE.

8.0 PGE Output SS, PS, CC Notation

For clarity, the **output** SamplingStrategy, ProductionStrategy, ConfigurationCode, Software and Data notations, per Subsystem and PGE, are listed in Table 3 as they exist to date. Appendix B contains an example of an 'ASCII Input File Generator Using Multiple SamplingStrategies, ProductionStrategies, and ConfigurationCodes'. Appendix C describes each PGE-set of input and output SS, PS and CC requirements.

Table 3: CERES PGE SamplingStrategy, ProductionStrategy, ConfigurationCode, Software and Data Output Notations

Subsystem#: SubsystemName	PGEName	SS_ID	PS_ID	CC_ID	SW_ID	DATA_ID
1: Instrument	1.1P1	SS1	PS1	CC1	SW1	DATA1
	1.1P2	SS1	PS1	CC1	SW1	DATA1
	1.1P3	SS1	PS1	CC1	SW1	DATA1
	1.1P4	SS1	PS1	CC1	SW1	DATA1
	1.1P5	SS1	PS1	CC1	SW1	DATA1

Table 3: CERES PGE SamplingStrategy, ProductionStrategy, ConfigurationCode, Software and Data Output Notations

Subsystem#: SubsystemName	PGEName	SS_ID	PS_ID	CC_ID	SW_ID	DATA_ID
	1.1P6	SS1	PS1	CC1	SW1	DATA1
	1.2P1	SS1	PS1	CC1	SW1	DATA1
2: ERBElike(Daily)	2.1P1	SS2_1	PS2_1	CC2_1	SW2_1	DATA2_1
	2.2P1	SS2	PS2	CC2	SW2	DATA2
	2.3P1	SS2	PS2	CC2	SW2	DATA2
	2.3P2	SS2	PS2	CC2	SW2	DATA2
3: ERBElike(Monthly)	3.1P1	SS3	PS3	CC3	SW3	DATA3
	3.2P1	SS3_2	PS3_2	CC3_2	SW3_2	DATA3_2
4.1-4.4: Clouds	4.1-4.0P1	SS4_0	PS4_0	CC4_0	SW4_0	DATA4_0
	4.1-4.1P1	SS4_1	PS4_1	CC4_1	SW4_1	DATA4_1
(additional outputs)		SS4_4	PS4_1	CC4_1	SW4_1	DATA4_1
	4.1-4.2P1	SS4_2	PS4_2	CC4_2	SW4_2	DATA4_2
	4.1-4.3P1	SS4_3	PS4_3	CC4_3	SW4_3	DATA4_3
4.5-4.6: Inversion	4.5-6.1P1	SS4_5	PS4_5	CC4_5	SW4_5	DATA4_5
5: InstantaneousSarb	5.1P1	SS5	PS5	CC5	SW5	DATA5
	5.2P1	SS5	PS5	CC5	SW5	DATA5
	5.3P1	SS5	PS5	CC5	SW5	DATA5
6: TisaGrid	6.1P1	SS6	PS6	CC6	SW6	DATA6
	6.2P1	SS6_2	PS6_2	CC6_2	SW6	DATA6
	6.3P1	SS6_3	PS6_3	CC6_3	SW6	DATA6
7.1: TisaAveraging	7.1.1P1	SS7_1	PS7_1	CC7_1	SW7_1	DATA7_1
7.2: SynopticSarb	7.2.1P1(-P8)	SS7_2	PS7_2	CC7_2	SW7_2	DATA7_2
	7.2.2P1	SS7_2	PS7_2	CC7_2	SW7_2	DATA7_2
8: TisaAveraging(8)	8.1P1	SS8	PS8	CC8	SW8	DATA8
9: TisaGrid	9.1P1	SS12	PS12	CC9	SW9	DATA9
	9.2P1	SS9	PS9	CC9	SW9	DATA9
	9.3P1	SS9_3	PS9_3	CC9_3	SW9	DATA9
	9.4P1	SS9_4	PS9_4	CC9_4	SW9	DATA9
10: TisaAveraging(10)	10.1P1	SS10	PS10	CC10	SW10	DATA10
11: GGeo	11.1P1	SS11_1	PS11_M	CC11	SW11	DATA11
	11.1P2	SS11_2	PS11_M	CC11	SW11	DATA11
	11.1P3	SS11_3	PS11_M	CC11	SW11	DATA11

Table 3: CERES PGE SamplingStrategy, ProductionStrategy, ConfigurationCode, Software and Data Output Notations

Subsystem#: SubsystemName	PGEName	SS_ID	PS_ID	CC_ID	SW_ID	DATA_ID
	11.1P4	SS11_4	PS11_M	CC11	SW11	DATA11
	11.2P1	SS11	PS11	CC11	SW11	DATA11
12: RegridMOA	12.1P1	SS12	PS12	CC12	SW12	DATA12

9.0 DAAC Responsibilities

The SamplingStrategies and ProductionStrategies will be supplied from the CERES DMT through the 'CERES DMT to DAAC Processing Request Form', see Section 3. The ConfigurationCode, SW-SCCR, and Data-SCCR numbers will be retrieved from the DAAC CM Database Table, as shown in Table 2, see Section 7.

The DAAC production processing personnel will supply the appropriate SamplingStrategy, ProductionStrategy, ConfigurationCode, SW-SCCR, and Data-SCCR numbers for each PGE prior to PGE instantiation into Production. This is done by a combination of a wrapper script, which retrieves the information from the LATIS Production Database, and/or a set of special DAAC 'Environment files' that are written and maintained at the DAAC. This detail is still under development.

Note: In addition to the Output SamplingStrategy for the PGE, the DAAC will provide the following:

SAT - Satellite (or Platform)
INST - Instrument
IMAG - Imager

See 'Example DAAC Environment Variable Script' following Section 10.

10.0 CERES Subsystem Software Development Team Responsibilities

10.1 Implementation - Create a Unique Environment Variable Script

Each Subsystem will create and source an environment variable script which is unique for each Subsystem-PGE. The environment variable script should be sourced within the ASCII file generator script. (Reference the Operator's Manual for each PGE for more detail information.) The environment variable script will set the following environment variables:

1. 3 Parameters required by the Metadata CERESlib Utilities:

Satellite (or Platform) = SAT
Instrument = INST

Imager = IMAG

2. An output SamplingStrategy environment variable for the processing PGE and an input SamplingStrategy environment variable for **each** of the PGEs which provide input to the processing PGE. The required names of these environment variables can be found in the Operator's Manual for each PGE.

3. An output ProductionStrategy environment variable for the processing PGE and an input ProductionStrategy environment variable for **each** of the PGEs which provide input to the processing PGE. The required names of these environment variables can be found in the Operator's Manual for each PGE.

4. A unique ConfigurationCode environment variable for the processing PGE and for **each** of the PGEs which provide input to the processing PGE. The required names of these ConfigurationCode environment variables can be found in the Operator's Manual for each PGE.

5. The Software SCCR# and DATA SCCR# parameters must be included for the processing PGE.

10.2 Environment Variable Script Restriction

As stated above, the environment variable script name used for the definition of the SamplingStrategies, ProductionStrategies, ConfigurationCodes, Software SCCR# and DATA SCCR# must be unique. The suggested script name is ENV(PGEName)-env.csh. If other parameters are required by the PCF Generator, another environment script must be created and sourced.

10.3 Generator Script Restrictions

The DAAC production processing personnel will acquire and supply the appropriate SamplingStrategy, ProductionStrategy, and ConfigurationCode numbers for each PGE prior to PGE instantiation into Production. The PGE environment variable script will be sourced within the PGEs' ASCII input file generators. All Sampling Strategies, Production Strategies, and Configuration Codes within the ASCII input file generators should be obtained by referencing the environment variables set in the PGE environment variable script. SamplingStrategies, ProductionStrategies, and ConfigurationCodes **should not be hard coded** within the ASCII input file generators, **nor** should they be passed into the generators as **command-line arguments**.

10.4 ENV(PGEname)-env.csh Delivery

Each Subsystem will be required to supply the required number of environment scripts necessary, for each PGE, in the Subsystem Delivery Package to the DAAC.

An example environment variable script for Subsystem 4.5-.6, ENV4.5-6.1P1-env.csh, follows this discussion.

Example of a DAAC Environment Variable Script (Sample)

```
#! /bin/csh -f
##########################################
#  ENV-CER4.5-6.1P1-env.csh
#
#  DAAC script which sets environment variables for
#  use in the ASCII input file for PGE Generator for PGE
#  CER4.5-6.1P1
##########################################
#
# read in $1

set SATS  = (TRMM Terra Terra)
set INSTRS = (PFM FM1 FM2)
set IMAGS = (VIRS MODIS MODIS)

#Read in an argument pointer and set the parameters for the SamplingStrategy
setenv SAT  $SATS[$1]
setenv INST $INSTRS[$1]
setenv IMAG $IMAGS[$1]

# Set Sampling Strategy Environment Variables
setenv SS4_5 $SAT\-$INST\-$IMAG
setenv SS4_1 $SAT\-$IMAG
setenv SS12 CERES #Fixed Sampling Strategy for SS12

# Set Production Strategy Environment Variables
setenv PS4_5 ValidationR2 #ps4_5
setenv PS4_1 ValidationR2 #ps4_1
setenv PS12  DAO-GEOS2 #ps12

# Set Configuration Code Environment Variables from DAAC DB
setenv CC4_5 009001 #cc4_5
setenv CC4_1 005002 #cc4_1
setenv CC12 003001 #cc12

# Set SCCR Environment Variables from DAAC DB
setenv SW4_5  090 #sw4_5
setenv DATA4_5  090 #da4_5
```

Example of a Subsystem Environment Variable Script

```
#! /bin/tcsh -f
##########################################
#  ENV4.5-6.1P1-env.csh
#
#  Inversion script which sets environment variables for
#  use in the ASCII input file for PGE Generator for PGE
#  CER4.5-6.1P1
##########################################

# Set Metatdata Environment Variables
setenv Satellite      $SAT
setevn Instrument $INST
setevn Imager      $IMAG


# Set Sampling Strategy Environment Variables
setenv outSS4_5  $SS4_5
setenv inSS4_1    $SS4_4
setenv inSS12      $SS12

# Set Production Strategy Environment Variables
setenv outPS4_5  $PS4_5
setenv inPS4_1    $PS4_1
setenv inPS12      $PS12

# Set Configuration Code Environment Variables
setenv CCode4_5  $CC4_5
setenv CCode4_1  $CC4_1
setenv CCode12    $CC12

# Set SCCR Environment Variables
setenv SWsccr4_5       $SW4_5
setenv DATAsccr4_5    $DATA4_5
```

Appendix A. Proposal for LATIS Configuration Management: Method to Track 'External' Element of the ConfigurationCode

The diagram 'CERES Subsystem Dependencies', on the next page, shows the processing flow of the CERES data. The processing flow begins with the Operating System and Libraries, which impact all software, followed by the 14 CERES Data Processing Subsystems. Included in this diagram are a few examples of the DAAC External Ancillary Ingested data sets and the Subsystems they impact.

The chart below is the tabular description of the diagram 'CERES Subsystem Dependencies' and shows which CERES Subsystems impact other Subsystems to produce a change in the processing history. This chart describes each Subsystem (parent - vertical column) and the relative Subsystems (children - horizontal row) which may be affected by a software change. For example: When Subsystem 2 (PGEs) submits an update in the software - that change may or may not affect (or manifest) an 'external' change to Subsystem 3 (PGEs). In most cases, the CERES Data Management Team will determine when a Subsystem's updates result as an external change to one or more subsidiary Subsystems. In these cases, 'manual' external updates will be made to the ConfigurationCode. A detail CERES PGE Matrix Chart can be found at URL: http://asd-www.larc.nasa.gov/ceres/intern_doc/.

CERES Subsystem Dependency Matrix Chart

Subsystem#	2	3	4.1-4.4	4.5-4.6	5	6	7.1	7.2	8	9	10
1	x	x	x	x	x	x	x	x	x	x	x
2		x									
4.1-4.4				x	x	x	x	x	x	x	x
4.5-4.6					x	x	x	x	x	x	x
5						x	x	x	x		
6							x	x	x		
7.1								x	x		
7.2									x		
9											x
11							x	x	x		x
12			x	x	x	x	x	x	x	x	x

The purpose for writing Appendix A is to describe two sets of additional tables that should be added to the LATIS CM system in order to capture and document the external changes from 1) System/Libraries and external changes from 2) External Data providers. These two sets of element changes can affect one or more PGE's external environment. The next two sections will describe each set of external elements in detail.

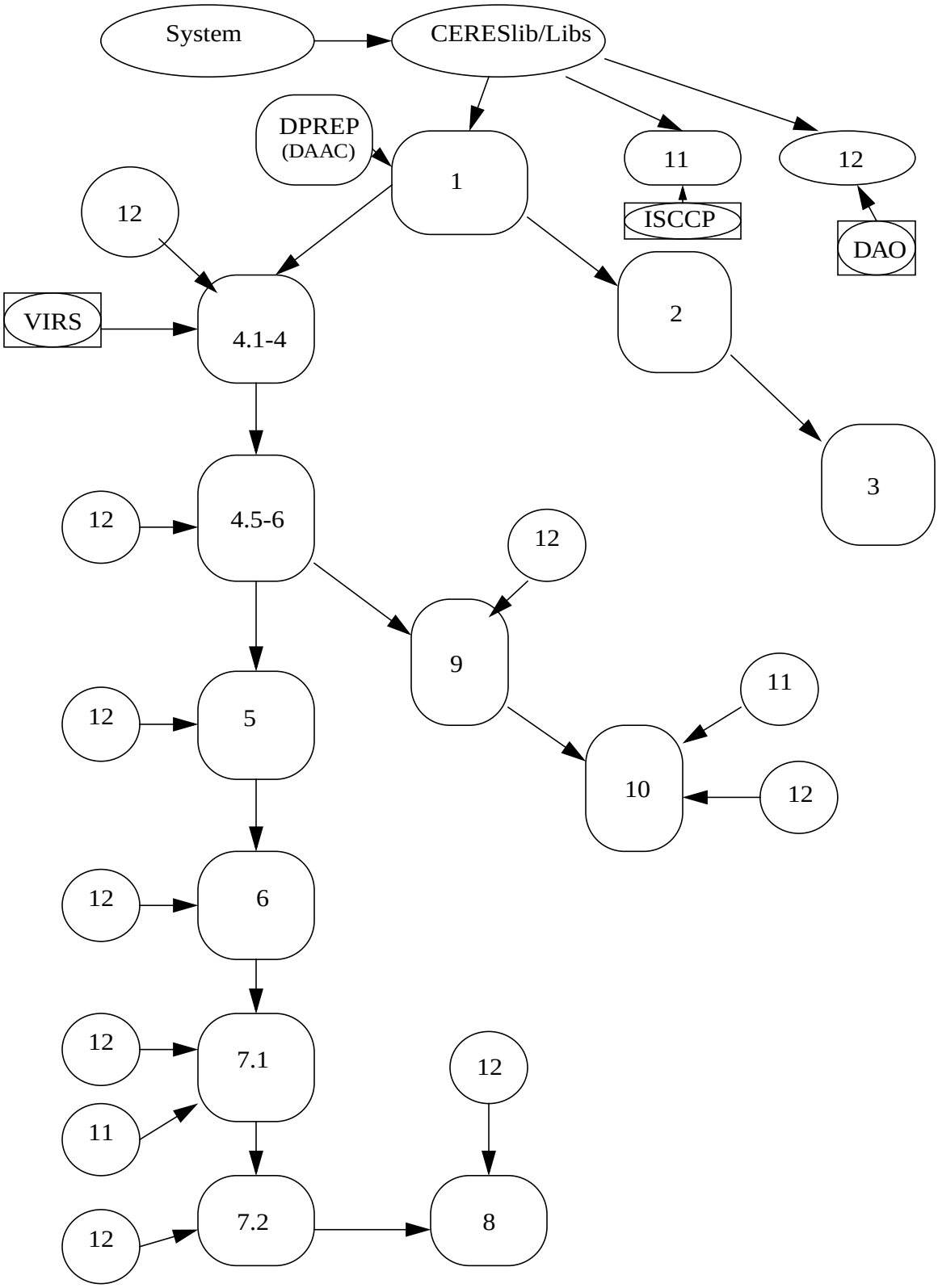

Diagram: CERES Subsystem Dependencies

CM Tracking 1: System and Library Changes

The chart below gives an overview of the Subsystems that are affected by changes either in the System or Libraries. Changes and upgrades of the LATIS System (Hardware, Support Software, and COTS) and support Libraries affect an external change for all of the CERES Processors.

System/Libraries/Subsystems Relationship Chart

Subsystem#	Libraries	1	2	3	4.1-4.4	4.5-4.6	5	6	7.1	7.2	8	9	10	11	12
System	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Libraries		x	x	x	x	x	x	x	x	x	x	x	x	x	x

Table A-1 is designed to document all of the System and Library updates. Here the valids for System will contain: {OS, CompF90, CompAda, Codine ..}, for Library will contain: {CERESlib, Toolkit, HDF, HDF-EOS, IDL, ..} where S/L_CC# records a new entry. Note: that there are only two Categories {System or Library} which are key elements in this table. As seen in the chart above, an upgrade or change in either System or Library will produce an external change for all CERES PGEs.

Table A-1: System/Library Configuration Management Table

Parameter	Format	Description	Example
Category: System or Library	s(20)	System or Library being updated	Library
SpecificSW	s(20)	The specific software being updated	Toolkit
S/L_ CC#	I3	A value assigned by the LATIS Database every time a new entry has been made into the table.	023
CC_Date	YYYYMMDD	The date that the new entry was made into the table.	19980122
Description	s(255)	Describe reason effecting the Change	TK5.2.1.L1 patch

Even though this table will be populated by manual entry - the purpose is to capture the event: the type of update and the date of the update. Most importantly, the function of this table is to **enable an automated query** of the information contained within the table.

CM Tracking 2: External Data Provider Changes

The second set of tables is designed to track and document the formal changes to: the format, source, new versions, naming convention, etc. made to the data sets ingested by the LATIS system. This table should also contain the external support programs that LATIS provides for preprocessing various data sets, such as {DPREP, Level 0, ORBSIM, ECMWF Preprocessor, Imager Preprocessors, etc}. These data sets and programs typically affect an external change to one or

more CERES PGEs. The chart below shows some of the CERES PGEs and the related programs and External Data Provider dependencies.

Table A-2: Subsystem/PGE vs. External Data Provider Chart

Subsystem#: SubsystemName	PGEName	DPREP (TRMM)	DPREP (Terra)	DPREP (Aqua)	SSM/I	DAS	ECMWF	SMOBA	EP-TOMS	ISCCP	VIRS	MODIS
1: Instrument	1.1P1	x										
	1.1P2	x										
	1.1P3		x									
	1.1P4		x									
	1.1P5			x								
	1.1P6			x								
2: ERBElike	2.1P1				x							
4.1-4.4: Clouds	4.1-4.0P1				x							
	4.1-4.1P1										x	x
11: GGeo	11.1P1									x		
	11.1P2									x		
	11.1P3									x		
	11.1P4									x		
	11.2P1									x		
12: RegridMOA	12.1P1					x	x	x	x			

Table A-3 documents DataSetName (Data Provider Identifier) examples are DAS, ECMWF, ISCCP {Geostationary Satellites: GOES-8, GOES-9, GMS-5, METEO-6}, VIRS, MODIS, different flavors of DPREP, etc., where I_CC# records a new entry. Note: that each Provider will be an element in Table A-3.

Table A-3: Data Provider Configuration Management Table

Parameter	Format	Description	Example
DataSet-Name	s(20)	Ingested Data Set (or Provider) Name	ISCCP
I_ CC#	I3	A value assigned by the LaTIS Database every time a new entry has been made into the table as a function of new DataSet change	011
CC_Date	YYYYMMDD	The date that the new entry was made into the table.	19980122
Description	s(255)	Describe new version # and reason effecting the Change	Meteo-7 replacing Meteo-6

The two tables A-2 and A-3 form a relationship that links a Provider (DataSet) with a PGE.

CM Usage of the new Tracking Tables

Table A-4 is a detail definition of the LATIS CM Table, shown as Table 2, Section 7. Table A-4 lists all PGEs, the related Subsystems, and tracks all **internal** Subsystem Software and Constant Ancillary Data changes, as recorded through the LATIS CM system. At the present time, the **external** ConfigurationCode element is a manual effort.

Recommend new DB feature: Write an automated script to determine the **external** ConfigurationCode element for a PGE at PGE-CM installation.

- For the PGEName, check the CC_Date of the last CM installation and look in Table A-1 for any external System or Library updates since the last CM installation.
- Check Tables A-2 and A-3 for external Provider updates since the last CM installation date.
- If there have been one or more influential external factors that have changed (since the last CM installation date) then increment the CC#ex by **one** (1) and record the list of external factors. If there have been NO external changes, then keep the same external CC#ex number as the last CM installation.

Table A-4: LATIS Configuration Management Table

Parameter	Format	Description	Example
PGEName	s(20)	The PGEName has been defined as follows: CERx.yPz, where x = Subsystem Identifier, y = the PGE, z = the PGE version (this implies a different PCF)	CER4.5-6.1P1
Subsystem#	s(20)	Number of the Subsystem submitting a new entry	4.5-4.6
CC#in	I3	Internal element of the CCode. A value assigned by the LATIS Database when a 'new' entry has been made into the table as a function of PGEName	025
CC_Date	YYYYMMDD	The date that the new entry was made into the table.	19971230
SWsccr#	I3	Software (SW) System Configuration Change Request (SCCR) number, as recorded at the (SCF) Configuration Management (CM) Database system, and is documented in the Delivery Memo accompanying the delivery of the Software	010
Date(SW)	YYYYMMDD	The date of the SWsccr, as documented in the Delivery Memo of the SW delivery.	19971121
DATAsccr#	I3	All Constant Ancillary Data, for each Subsystem, will be placed into the LATIS CM system. The sccr number accompanying the data, as documented in the Delivery Memo, will be transcribed here.	018
Date(DATA)	YYYYMMDD	The date of the Constant Ancillary DATAsccr, as documented in the Delivery Memo of the DATA delivery.	19971221
CC#ex	I3	External element of the CCode. A value assigned by the LATIS Database reflecting the external impacts from Tables A-2 and A-3.	093

Parameter	Format	Description	Example
delivery_scope	list	valids: {complete, delta}, describes the scope of the delivery	complete
new table parameter below			
S/L_ CC#, or I_CC#, (SS# - determined by DMT)	A(s20))	1. Array of Table # and corresponding Configuration code of the External Factors (S/L_ CC# and/or I_CC# values) or 2. DMT manual entry - Previous Subsystem effective change.	T1-023,T2-011,etc. or SS(2)

For a current listing of the CERES PGEs that have been logged into the LATIS CM system reference: http://latis.larc.nasa.gov:44712/config_mgmt/. Click on ‘CERES CM Information’.

Appendix B. Example of ASCII Input File Generator Using Multiple SamplingStrategies, ProductionStrategies and Configuration Codes

```
#! /bin/tcsh -f
###########################################
#  ascii_gen_4.5-6.1P1
#
#  Inversion script which simulates LaTIS PGE-unique Preprocessor
#  and creates ASCII input file to test the PGE Generator for PGE
#  4.5-6.1P1.
#
#  The CERES Inversion environment variable script, inversion-env.csh,
#  must be sourced before running this  script
#
#  This will be a LaTIS function and is provided here to
#  provide input for PGE Generator testing.
###########################################
#   The following parameters must be set on the command line:
#   $1 is the 4-digit data year
#   $2 is the 2-digit data month
#   $3 is the 2-digit data day
#   $4 is the 2-digit data hour of the day
#
# Example:  ascii_gen_4.5-6.1P1 1997 12 28 00
#
# The following environment variables are set by sourcing
# environment file inversion-env.csh :
#  $CCode4_5            - the Configuration Code for Subsysytems 4.5 and 4.6
#  $CCode4_1            - the Configuration Code for Subsysytems 4.1 through 4.4
#  $CCode12             - the Configuration Code for Subsysytem 12
#  $outPS4_5            - Production Strategy for Subsysytems 4.5 and 4.6 output files
#  $inPS4_1             - Production Strategy for input from Subsysytems 4.1 through 4.4
#  $inPS12              - Production Strategy for input from Subsysytem 12
#  $outSS4_5            - Sampling Strategy for Subsysytems 4.5 and 4.6 output files
#  $inSS4_1             - Sampling Strategy for input from Subsysytems 4.1 through 4.4
#  $inSS12              - Sampling Strategy for input from Subsysytem 12
#  $SWsccr4_5           - Software SCCR number for Subsysytems 4.5 and 4.6
#  $DATAsccr4_5         - Data SCCR number for Subsysytems 4.5 and 4.6
###########################################
```

source ENV4.5-6.1P1-env.csh

```
set PGENam = CER4.5-6.1P1

set CERYear = $1
set CERMon = $2
set CERDay = $3
set CERHrDay = $4
#
set SatInst = $outSS4_5
set AncData = ERBE_ADMs
set SP_MODEL = 1
set SURF_ALG = 1
```

```
@ temp1 = (((($CERDay - 1) * 24) + $CERHrDay + 1)
set CERHrMon = $temp1

################################################
# Create additional environment variables
################################################
#set RUN = $CERYear$CERMon$CERDay\_$CERHrDay
set INSTANCE_inv = $outSS4_5\_$outPS4_5\_$CCode4_5\.$CERYear$CERMon$CERDay$CERHrDay
set INSTANCE_cld = $inSS4_1\_$inPS4_1\_$CCode4_1\.$CERYear$CERMon$CERDay$CERHrDay
set INSTANCE_moa = $inSS12\_$inPS12\_$CCode12\.$CERYear$CERMon$CERDay$CERHrDay

if ( -e CER4.5-6.1P1_PCFin_$INSTANCE_inv)  \rm CER4.5-6.1P1_PCFin_$INSTANCE_inv
touch CER4.5-6.1P1_PCFin_$INSTANCE_inv
set pcf_input = CER4.5-6.1P1_PCFin_$INSTANCE_inv
################################################
# Create the ASCII input file for PCF generator
################################################

echo "############################"                                    >> $pcf_input
echo "# CERES baseline Metadata"                                      >> $pcf_input
echo "############################"                                    >> $pcf_input
echo "PGEName = $PGENam"                                              >> $pcf_input
echo "SamplingStrategy = $outSS4_5"                                   >> $pcf_input
echo "ProductionStrategy = $outPS4_5"                                 >> $pcf_input
echo "CERDataDateYear = $CERYear"                                     >> $pcf_input
echo "CERDataDateMonth = $CERMon"                                     >> $pcf_input
echo "CERDataDateDay = $CERDay"                                       >> $pcf_input
echo "CERHrOfMonth = $CERHrMon"                                       >> $pcf_input
echo "CERHrOfDay  = $CERHrDay"                                        >> $pcf_input
echo "ConfigurationCode = $CCode4_5"                                  >> $pcf_input
echo "SWsccr = $SWsccr4_5"                                            >> $pcf_input
echo "DATAsccr = $DATAsccr4_5"                                        >> $pcf_input
echo ""                                                               >> $pcf_input
echo "###################################"                            >> $pcf_input
echo "# PGE specific runtime parameters"                              >> $pcf_input
echo "###################################"                            >> $pcf_input
echo "Satellite = $Satellite"                                         >> $pcf_input
echo "Instrument = $Instrument"                                       >> $pcf_input
echo "Imager = $Imager"                                               >> $pcf_input
echo "Satellite_Instrument = $SatInst"                                >> $pcf_input
echo "Ancillary_Data_Set = $AncData"                                  >> $pcf_input
echo "SP_MODEL_NUM = $SP_MODEL"                                       >> $pcf_input
echo "RUN_SURF_ALG = $SURF_ALG"                                       >> $pcf_input
echo "TK_Ver = SCF B.0 TK5.2.1"                                       >> $pcf_input
echo ""                                                               >> $pcf_input
echo "###################################"                            >> $pcf_input
echo "# PCF required directories"                                     >> $pcf_input
echo "###################################"                            >> $pcf_input
echo "SS4.5_InputDir.1 = $CERESHOME/clouds/data/out_comp/data/SSF_Int"  >> $pcf_input
echo "SS4.5_InputDir.2 = $CERESHOME/clouds/data/out_comp/QA_Reports"    >> $pcf_input
echo "SS4.5_InputDir.3 = $CERESHOME/sarb/data/out_comp/data/regridmoa">> $pcf_input
echo "SS4.5_InputDir.4 = $CERESHOME/inversion/data/ancillary/static"    >> $pcf_input
echo "SS4.5_InputDir.5 = $CERESHOME/shared_data"                        >> $pcf_input
echo "SS4.5_OutputDir.1 = $CERESHOME/inversion/data/out_comp/data"      >> $pcf_input
```

```
echo "SS4.5_OutputDir.2 = $CERESHOME/inversion/data/out_comp/QC"      >> $pcf_input
echo "SS4.5_LogsDir =  $CERESHOME/inversion/data/runlogs"             >> $pcf_input
echo "SS4.5_MCFDir = $CERESHOME/inversion/rcf"                        >> $pcf_input
echo "SS4.5_TempDir = $CERESHOME/inversion/data/scr"                  >> $pcf_input
echo ""                                                               >> $pcf_input
echo "####################################"                          >> $pcf_input
echo "# Input file names"                                            >> $pcf_input
echo "####################################"                          >> $pcf_input
echo "SS4.5_Inputfile.1 = CER_SSFI_$INSTANCE_cld"                     >> $pcf_input
echo "SS4.5_Inputfile.2 = CER_FQCI_$INSTANCE_cld"                     >> $pcf_input
echo "SS4.5_Inputfile.3 = CER_MOA_$INSTANCE_moa"                      >> $pcf_input
echo "SS4.5_Inputfile.4 = IISCTRM.19980202"                           >> $pcf_input
echo "SS4.5_Inputfile.5_1 = NIISW03.19971101"                         >> $pcf_input
echo "SS4.5_Inputfile.5_2 = NIILWAT.19971101"                         >> $pcf_input
echo "SS4.5_Inputfile.5_3 = NIILWWN.19971101"                         >> $pcf_input
echo "SS4.5_Inputfile.5_4 = NIILWSP.19971101"                         >> $pcf_input
echo "SS4.5_Inputfile.5_5 = NIILWSM.19971101"                         >> $pcf_input
echo ""                                                               >> $pcf_input
echo "####################################"                          >> $pcf_input
echo "# Output file names"                                           >> $pcf_input
echo "####################################"                          >> $pcf_input
echo "SS4.5_Outputfile.1 = CER_SSFB_$INSTANCE_inv"                    >> $pcf_input
echo "SS4.5_Outputfile.2 = CER_GQCA_$INSTANCE_inv"                    >> $pcf_input
echo "SS4.5_Outputfile.3 = CER_GQCI_$INSTANCE_inv"                    >> $pcf_input
echo ""                                                               >> $pcf_input
echo "####################################"                          >> $pcf_input
echo "# Log file names"                                              >> $pcf_input
echo "####################################"                          >> $pcf_input
echo ""                                                               >> $pcf_input
echo "SS4.5_Logsfile.1 = CER4.5-6.1P1_LogStatus_$INSTANCE_inv"        >> $pcf_input
echo "SS4.5_Logsfile.2 = CER4.5-6.1P1_LogReport_$INSTANCE_inv"        >> $pcf_input
echo "SS4.5_Logsfile.3 = CER4.5-6.1P1_LogUser_$INSTANCE_inv"          >> $pcf_input
chmod 777 $pcf_input
echo $pcf_input
```

Appendix C. PGE Input/Output SS, PS, CC Notations

Table C-1 lists each CERES Product Generation Executive (PGE). The PGE notations listed here contain only the major Input and Output Products. Contained in this table are:
Parent PGE (for PGE-Dependent input files);
I/O, where I = Input file, O = Output file;
m/o, where m = mandatory, o = optional;
the 'Input/Output Product ID' is the file identifier;
the SamplingStrategy (SS), ProductionStrategy (PS), and ConfigurationCode (CC) notation;
the Target PGEs for the Output files.
(Note: Subscripts i - implies that there are different flavors of the product, d - day)

Table C-1. PGE Input/Output SS, PS, CC Notations

PGE	Parent PGE	I/O	m/o	Input/Output Product ID	SS	PS	CC	Target PGE(s)
1.1P1	DPREP (0.1P1)	I	m	LZ				
		O	o	IES	SS1	PS1	CC1	4.1-4.1P1
		O	o	BDS_i	SS1	PS1	CC1	1.2P1
1.1P2	DPREP (0.1P1)	I	m	QL				
		O	m	BDS_i	SS1	PS1	CC1	
1.1P3	LDAAC-DPREP	I	m	LZ				
		O	o	IES	SS1	PS1	CC1	4.1-4.1P1
		O	o	BDS_i	SS1	PS1	CC1	1.2P1
1.1P4	LDAAC-DPREP	I	m	QL				
		O	m	BDS_i	SS1	PS1	CC1	
1.2P1	1.1P1	I	m	BDS	SS1	PS1	CC1	
		O	m	PRES8	SS1	PS1	CC1	2.2P1, 2.3P1, 2.3P2
2.1P1	N/A	O	m	SNOW	SS2_1	PS2_1	CC2_1	2.2P1, 2.3P1, 2.3P2
2.2P1	1.2P1	I	m	PRES8	SS1	PS1	CC1	
	2.1P1	I	m	SNOW	SS2_1	PS2_1	CC2_1	
		O	m	ES8B	SS2	PS2	CC2	
		O	m	ES8	SS2	PS2	CC2	
		O	m	CQCI	SS2	PS2	CC2	
		O	m	EID6	SS2	PS2	CC2	3.1P1
2.3P1	1.2P1	I	m	PRES8	SS1	PS1	CC1	
	2.1P1	I	m	SNOW	SS2_1	PS2_1	CC2_1	
		O	o	CXDR	SS2	PS2	CC2	3.1P1

Table C-1. PGE Input/Output SS, PS, CC Notations

PGE	Parent PGE	I/O	m/o	Input/Output Product ID	SS	PS	CC	Target PGE(s)
2.3P2	1.2P1	I	m	PRES8	SS1	PS1	CC1	
	2.1P1	I	m	SNOW	SS2_1	PS2_1	CC2_1	
		O	o	CXDR	SS2	PS2	CC2	3.1P1
3.1P1	2.3P1, 2.3P2	I	o	CXDR	SS2	PS2	CC2	
	2.2P1	I	o	EID6	SS2	PS2	CC2	
		O	m	DES9	SS3	PS3	CC3	3.2P1
		O	m	ES9	SS3	PS3	CC3	
		O	m	ES4	SS3	PS3	CC3	
3.2P1	3.1P1	I	m	DES9	SS3_2in	PS3_2in	CC3_2in	
		O	m	DES9	SS3_2	PS3_2	CC3_2	
		O	m	ES9	SS3_2	PS3_2	CC3_2	
		O	m	ES4	SS3_2	PS3_2	CC3_2	
12.1P1		O	m	MOA	SS12	PS12	CC12	4.1-4.1P1, 4.5-6.1P1, 5.1P1, 7.2.1P1-8, 9.1P1
4.1-4.0P1		O	m	EICE	SS4_0	PS4_0	CC4_0	4.1-4.1P1, 5.1P1
		O	m	ESNOW	SS4_0	PS4_0	CC4_0	4.1-4.1P1, 5.1P1
4.1-4.1P1	1.1P1	I	o	IESi	SS1	PS1	CC1	
	12.1P1	I	m	MOA	SS12	PS12	CC12	
	4.1-4.0P1	I	m	EICE	SS4_0	PS4_0	CC4_0	
	4.1-4.0P1	I	m	ESNOW	SS4_0	PS4_0	CC4_0	
	4.1-4.2P1	I	o	ECS-OAi	SS4_2	PS4_2	CC4_2	
	4.1-4.2P1	I	o	ECS-BTi	SS4_2	PS4_2	CC4_2	
		O	o	EQCHB	SS4_1	PS4_1	CC4_1	4.1-4.2P1
		O	o	EQCHG	SS4_1	PS4_1	CC4_1	4.1-4.2P1
		O	o	CRHU	SS4_1	PS4_1	CC4_1	4.1-4.2P1
		O	o	SSFIi	SS4_4	PS4_1	CC4_1	4.5-6.1P1
		O	o	FQCIi	SS4_4	PS4_1	CC4_1	4.5-6.1P1
4.1-4.2P1	4.1-4.1P1	I	o	EQCHB	SS4_1	PS4_1	CC4_1	
	4.1-4.1P1	I	o	EQCHG	SS4_1	PS4_1	CC4_1	
	4.1-4.1P1	I	o	CRHU	SS4_1	PS4_1	CC4_1	
	4.1-4.2P1	I	o	$ECS\text{-}OA_{i,d}$	SS4_2	PS4_2	CC4_2	
	4.1-4.2P1	I	o	$ECS\text{-}BT_{i,d}$	SS4_2	PS4_2	CC4_2	

Table C-1. PGE Input/Output SS, PS, CC Notations

PGE	Parent PGE	I/O	m/o	Input/Output Product ID	SS	PS	CC	Target PGE(s)
		O	o	ECS-$OA_{i,d+1}$	SS4_2	PS4_2	CC4_2	4.1-4.1P1,4.1-4.2P1
		O	o	ECS-$BT_{i,d+1}$	SS4_2	PS4_2	CC4_2	4.1-4.1P1,4.1-4.2P1
		O	o	EQCDG	SS4_2	PS4_2	CC4_2	4.1-4.3P1
		O	o	EQCDB	SS4_2	PS4_2	CC4_2	4.1-4.3P1
		O	o	EQCDS	SS4_2	PS4_2	CC4_2	
4.1-4.3P1	4.1-4.2P1	I	o	EQCDG	SS4_2	PS4_2	CC4_2	
	4.1-4.2P1	I	o	EQCDB	SS4_2	PS4_2	CC4_2	
		O	o	EQCMG	SS4_3	PS4_3	CC4_3	
		O	o	EQCMB	SS4_3	PS4_3	CC4_3	
4.5-6.1P1	12.1P1	I	m	MOA	SS12	PS12	CC12	
	4.1-4.1P1	I	m	SSFI	SS4_4	PS4_1	CC4_1	
	4.1-4.1P1	I	m	FQCI	SS4_4	PS4_1	CC4_1	
		O	m	SSFB	SS4_5	PS4_5	CC4_5	4.5-6.2P1, 5.1P1, 9.2P1
		O	m	SSF	SS4_5	PS4_5	CC4_5	
4.5-6.2P1	4.5-6.1P1	I	m	SSFB	SS4_5	PS4_5	CC4_5	
		O	m	SSFS-DAY	SS4_5	PS4_5	CC4_5	
		O	m	SSFS-NIT	SS4_5	PS4_5	CC4_5	
5.1P1	4.1-4.0P1	I	m	EICE	SS4_0	PS4_0	CC4_0	
	4.1-4.0P1	I	m	ESNOW	SS4_0	PS4_0	CC4_0	
	4.5-6.1P1	I	m	SSFB	SS4_5	PS4_5	CC4_5	
	12.1P1	I	m	MOA	SS12	PS12	CC12	
		O	m	CRSB	SS5	PS5	CC5	6.1P1
		O	m	CRS	SS5	PS5	CC5	
		O	m	HSALU	SS5	PS5	CC5	5.3P1 (??)
9.1P1	12.1P1	I	m	MOA	SS12	PS12	CC12	
		O	m	PMOAi	SS12	PS12	CC9_1	6.1P1, 7.1.1P1, 8.1P1, 9.2P1, 10.1P1
9.2P1	9.1P1	I	m	PMOAi	SS12	PS12	CC9_1	
	4.5-6.1P1	I	m	SSFB	SS4_5	PS4_5	CC4_5	
		O	m	SFC-HR	SS9	PS9	CC9	9.3P1
		O	o	MOVLP	SS9	PS9	CC9	9.3P1
9.3P1	9.2P1	I	o	SFC-HR	SS9_3in	PS9_3in	CC9_3in	

Table C-1. PGE Input/Output SS, PS, CC Notations

PGE	Parent PGE	I/O	m/o	Input/Output Product ID	SS	PS	CC	Target PGE(s)
	9.2P1	I	o	MOVLP	SS9_3in	PS9_3in	CC9_3in	
		O	o	SFCB	SS9_3	PS9_3	CC9_3	9.4P1, 10.1P1
9.4P1	9.3P1	I	o	SFCB	SS9_3	PS9_3	CC9_3	
		O	m	SFC	SS9_4	PS9_4	CC9_4	
6.1P1	5.1P1	I	m	CRSB	SS5	PS5	CC5	
	9.1P1	I	m	PMOAi	SS12	PS12	CC9_1	
		O	m	FSW-HR	SS6	PS6	CC6	6.2P1
6.2P1	6.1P1	I	o	FSW-HR	SS6_2in	PS6_2in	CC6_2in	
		O	o	FSWB	SS6_2	PS6_2	CC6_2	6.3P1, 7.1.1P1
6.3P1	6.2P1	I	o	FSWB	SS6_2	PS6_2	CC6_2	
		O	o	FSW	SS6_3	PS6_3	CC6_3	
11.1P1	(Ingest Data) GOES-#1	O	m	GRAN	SS11_1	PS11_M	CC11	11.2P1
11.1P2	(Ingest Data) GOES-#2	O	m	GRAN	SS11_2	PS11_M	CC11	11.2P1
11.1P3	(Ingest Data) METEO-#3	O	m	GRAN	SS11_3	PS11_M	CC11	11.2P1
11.1P4	(Ingest Data) GMS-#4	O	m	GRAN	SS11_4	PS11_M	CC11	11.2P1
11.2P1	11.1P1	I	o	**(** GOES-#1) GRAN	SS11_1	PS11_M	CC11	
	11.1P2	I	o	**(**GOES-#2) GRAN	SS11_2	PS11_M	CC11	
	11.1P3	I	o	(METEO-#3) GRAN	SS11_3	PS11_M	CC11	
	11.1P4	I	o	**(**GMS-#4) GRAN	SS11_4	PS11_M	CC11	
		O	m	GGEO	SS11	PS11	CC11	7.1.1P1, 10.1P1
7.1.1P1	6.2P1	I	o	FSWB	SS6_2	PS6_2	CC6_2	
	9.1P1	I	m	PMOA	SS12	PS12	CC9_1	
	11.2P1	I	o	GGEO	SS11	PS11	CC11	
		O	m	TSI	SS7_1	PS7_1	CC7_1	7.2.1P1-8
		O	m	TSIN	SS7_1	PS7_1	CC7_1	7.2.1P1-8
7.2.1P1-8	7.1.1P1	I	m	TSI	SS7_1	PS7_1	CC7_1	
	7.1.1P1	I	m	TSIN	SS7_1	PS7_1	CC7_1	
	12.1P1	I	m	MOA	SS12	PS12	CC12	

Table C-1. PGE Input/Output SS, PS, CC Notations

PGE	Parent PGE	I/O	m/o	Input/Output Product ID	SS	PS	CC	Target PGE(s)
		O	m	SYNB	SS7_2	PS7_2	CC7_2	7.2.2P1, 8.1P1
7.2.2P1	7.2.1P1-8	I	m	SYNB	SS7_2	PS7_2	CC7_2	
		O	m	SYN	SS7_2	PS7_2	CC7_2	
8.1P1	7.2.1P1-8	I	o	SYNB	SS7_2	PS7_2	CC7_2	
	9.1P1	I	m	PMOA	SS12	PS12	CC9_1	
		O	m	AVG,ZAVG	SS8	PS8	CC8	
10.1P1	9.1P1	I	m	PMOAi	SS12	PS12	CC9_1	
	11.2P1	I	o	GGEO	SS11	PS11	CC11	
	9.3P1	I	o	SFCB	SS9_3	PS9_3	CC9_3	
		O	m	SRBAVG1, SRBAVG2	SS10	PS10	CC10	